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ABSTRACT

The use of an established research method, Research on Teacher Effectiveness (RTE), is considered as it may be applied to examine successful teaching methods in physical activities and sports. The basic process of RTE is observing teachers at work with students in the classroom or gymnasium. Research on the relationship between teaching behaviors and methods and student achievement in physical activities has, in the past, been limited. Conclusions on teacher effectiveness reached by the RTE process are discussed as they apply to academic achievement, and projection is made on their validity when considered in the area of physical achievement. (JD)

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TEACHING AND LEARNING PROCESSES IN PHYSICAL ACTIVITY:

THE CENTRAL PROBLEM OF SPORT PEDAGOGY

by

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Amateur anthropoligists have observed that professors everywhere like to begin a course of lectures with the argument that their subject rests, undisputed, at the center of all human knowledge. Every year thousands of dusty blackboards all over the world bear mute witness to this process. Diagrams with boxes and arrows, pictographic wheels with radiating spokes, and a myriad of other graphic metaphors all proclaim the centrality of astronomy, literature, physics, philosophy, law or education within the architectonic system favored by each professor.

In contrast to that time-honored tradition, I do not propose to explain where Sport Pedagogy properly rests in the cosmology of Sport Science nor, in all candor, do I pretend to know. We now have a plethora of alternative models for the structure of a discipline (HAAG, 1978), most of them designed either to impress our academic colleagues with the legitimacy of our work, or to appease that obsessive drive for tidyness which beats in the breast of every true pedagogue.

In the natural evolution of Sport Pedgogy as a domain of inquiry, we already find ourselves less concerned with the grand questions of structure and more concerned with the particulars of content and process. The title devised by the Conference Committee for this Symposium, Teaching and Learning Processes in Physical Activity: The Central Problem of Sport Pedagogy, makes that explicit.

Teaching and learning are the processes at the heart of Sport Pedagogy, and research which probes the problem of their nature forms the content of that discipline. This Symposium will include two subsequent lectures on the principles and significance of evaluating teaching and learning processes. Only that busy schedule prevents the exercise of my professorial inclination to demonstrate here that the study of teaching forms the true foundation of all sport sciences -- if not all human knowledge.

Territorial definitions in science do have some function in that they act as constraints on the objects accepted for inquiry and, more indirectly, in that they shape methods of research. For example, when research on teaching is narrowly defined as any study in which teacher behavior serves as the independent variable and pupil learning as the dependent variable (GAGE, 1968), the territory has been defined in a manner which constrains both the objects of study (students and teachers) and the general mode of inquiry (empirical, quantitative and experimental).

When research on teaching is more broadly defined, the number of both targets for inquiry and modes of investigations are expanded. For example, the definition provided by DUNCAN and BIDDLE (1974) includes the contextual factors of the learning environment, presage factors such as student and teacher characteristics, and mediating processes such as student learning behaviors, all in addition to the nuclear factors of pedagogical process and learning products. With such an inclusive definition not only is the investigator caused to consider a larger array of potential subjects for investigation, but a number of alternative research strategies as well. The relation of context to teaching processes, or teaching behaviors to student learning behaviors, now

may be as attractive as the more traditional "teaching process/learning product" paradigm.

Over the last decade the prevalence of territorial models like that of Duncan and Biddle has been associated in the USA with a renaissance of pedagogical study. There has been a sharp upturn in the quality and quantity of educational research. Now, with the usual delay of a decade, research in Sport Pedagogy (what we in the USA persist in calling research on teaching physical education) is beginning to participate in that same happy surge of interest and fortune (LOCKE, 1977).

This is not to say that knowledge born of research evidence plays any larger role in the training of teachers or the conduct of instruction. Teacher educators and teachers continue to make decisions based largely on the sources of intuition, tradition and common sense. This is to say, however, that by standards internal to the fraternity of educational researchers, the technology of inquiry is at last catching up with the complexity of teaching as it really exists. The consequence is greater confidence in the reliability, validity and potential utility of results.

Even with a rapidly improving knowledge base, however, there is general agreement that research has little immediate impact on the conduct of education (JONCICH CLIFFORD, 1973) or, more specifically, on physical education in the schools (LOCKE, 1969). The only exceptions to this generalization have been in developing educational policy and in such adjunctive areas as intellectual measurement and school finance. (SUPPES, 1978).

Why educational research should have been so impotent in an advanced technological society is a dilemma best captured in the nature of the duck. Do our web-footed friends stay dry because of the nature of water, or is it the nature of their backs? Does research not get through to influence the teacher because it lacks penetrating power, or is it the natural resistance of the teacher and the school culture which prevents a thorough soaking of pedagogy in the invigorating showers of scientific knowledge? A lively case can be made for either point of view. The waters of educational research have not been very wet, and the back of the average teacher is absolutely waterproof.

The fact that real ducks sink like stones when deprived of their natural waterproofing, should give caution to those who advise the development of more elaborate and sophisticated schemes for influencing teacher behavior with interventions based upon our present body of research. Only recently has it been possible to conclude that the research literature contains any information about classroom teaching which is worth knowing (GAGE, 1978). It will be some years yet before research in Sport Pedagogy presents us with a body of reliable knowledge that will be useful in the gymnasium. For the present we might be thankful for the protection afforded by the natural caution and skeptical attitudes of teachers and coaches.

Why teachers are impervious to research is a complex matter which we are just beginning to understand (LORTIE, 1975). On the research side of the equation, however, it is easier to discern the roots of the problem. In the USA, there have been four conditions which limit the utility of research in sport pedagogy. First among these is the problem of poor quality. Most research on teaching has been done by graduate students who by definition are novices, and by circumstance are both impoverished and in a great hurry. These are not conditions conducive to the operation of a scholarly enterprise. The second problem is one of quantity. Research on teaching physical activity constitutes only 10 to 15 percent of all the sport science research produced each year (NIXON/LOCKE, 1973). After discounting the studies which employed inadequate methodology, the remaining body of literature is small indeed. The third problem is that of limited dissemination. The research we do have available tends to sit in university libraries largely unread, and certainly unloved. The final and fatal problem rests in the distinction between research and research development. If improved school practice is the target, then we need a great deal more than research--or disseminated research. We need products in the form of useful materials, devices, systems and methods, all designed to take advantage of knowledge. In short, we need a technology for converting the findings of research on Sport Pedagogy from constructs to constructions, from thoughts to things. Most researchers still cling to the twin fantasies: "to know the right is to do the right," and "teachers will construct their own applications of basic pedagogical research." Neither fantasy has any basis in fact.

An example of the historic problems of research on teaching physical education in the USA is seen in a specie of investigation called "methods" research. To produce methods research the recipe requires that you take a graduate student, one wife or husband, one and three-fifths children, a one year leave of absence from regular employment, a totally inadequate living stipend, an overload of academic courses, an incipient ulcer, and shake well. He or she takes one college volley ball class and teaches it by means of his or her new, innovative method. He or she then takes one other volleyball class as a control group and teaches by what commonly is called, "the traditonal method." The student then proceeds to measure and compare how much the students learn in each class.

In 80 percent of such studies there is no significant difference in the learning produced. Curiously, despite this result the investigator often concludes that the innovative method still is superior. The explanation usually offered is that the tools of measurement used in the study were inadequate to capture the elusive difference which certainly must have been present. Most of these students then proceed to write their theses or dissertations, receive their degrees, and return home to live happily ever after.

In 18 percent of the cases there is a difference and mirabile dictu, it favors the experimental method! The investigator confidently says, "I told you so." Research has confirmed yet another definition of good teaching. Of course in 2 percent of the cases it is discovered that subjects in the control group learned more volleyball with the traditional method. Students with this unhappy result write very carefully because they have a delicate problem.

In very few of these studies do we find anything dependable about how to teach physical activities. The studies which show no difference certainly tell us nothing. Most of them come out that way because of a weak experimental treatment. The innovative method often isn't sufficiently robust to make a difference large enough to show up on the gross measures of student learning that are employed. Any experienced teacher would predict that. Most of the strategies we try do not make much difference when taken by themselves. Whatever good teachers may be, they don't achieve that status because of some simple trick like using films, asking more indirect questions, teaching students some mechanical principles, or serving the ball through a target loop. You can't introduce an altered sequence of learning tasks into a volleyball class and expect a consequent difference to show up on a crude measure such as the thirty second wall-volley test.

As for the instances when methods research does reveal a difference between the learning of students in treatment and control groups, the question is whether or not you can believe it. The answer is that almost nobody does! The reasons for such skepticism range from technical to simple common sense. Even if everything is done properly in such an experiment, all you can suggest is that one particualr teacher was able to make that method work for one particular group of students, under one particular set of circumstances. If you wish to claim that this constitutes knowledge about good teaching, then you also must assume that any teacher could make the method work with any group of students under any set of circumstances. Only people who have never taught are likely to hold such assumptions comfortably. The most fundamental limitation of such studies, however, rests in the fact that there is no direct and systematic observation of what the teacher actually is doing in the experimental treatment. Without empirical confirmation of the exact nature of the independent variable there is no way to make sense out of any result.

In the last decade, this depressing picture of research on teaching has begun slowly to change. The lessons of seventy-five years have been painfully learned and new kinds of research on teaching have evolved (BORICH, 1977; COOLEY et al., 1977; DOYLE, 1977; GAGE, 1976). One of these is called Research on Teacher Effectiveness (RTE). RTE starts with a fascinating idea. "Effective teaching must be whatever is done by teachers who get good results." Obviously, the way to find out what effective teachers do is to watch them doing it. Thus, RTE is built around the process

of observing real teachers at work with real students in real schools.

The first demand of this process is that an accurate record be made of what teachers actually do. To accomplish that, researchers use teacher observation instruments (BORICH/MADDEN, 1977). The idea behind such tools is both simple and familiar. Basketball coaches, for example, learned many years ago that it is unwise to trust to memory for impressions of a game. The coach sends someone to sit in the stands with a sheet marked to look like a basketball court, on which small code marks are recorded to indicate who shoots from where and with what results. Such "shot charts" are records of player behavior. At half-time, or after the game, the coach simply adds up the marks to obtain an accurate picture of events which might have escaped observation or been distorted by expectation.

Teacher observation instruments are the shot charts of RTE. It is possible to record almost anything the teacher does, from smiling, to the kinds of questions asked, to how long the teacher waits for an answer. These tools can be sharpened through development to the point where two independent observers can watch the same set of events and produce remarkably similar reports (SIEDENTOP/OLSON, 1978).

The second thing required in RTE is a good measure of the product, usually in the form of student learning. The measurement of learning always has represented a difficult problem, but no one now seriously doubts that it can be accomplished. Reliable measures of cognitive learning in such tool areas as mathematics and language instruction now are commonplace. Reliable measures of learning in physical education are more difficult to find. Again, however, whether it is a simple event such as shooting accuracy from the foul line, or a more complex measurement problem such as quality of execution in the breast stroke, there is no technical reason which prohibits us from devising a reliable measure, provided we are willing to expend the effort. Only complex, interactive team sports may be beyond our present capacity to design measures of student learning.

With these two forms of measurement in hand, teacher observation instruments and reliable measures of student learning, RTE does the obvious. It provides an arrangement for asking the question, "How does one set of observed events relate to the other set of observed events?" Do teachers who get the best results do things differently from those who get poor results?

There are a great many ways of accomplishing this last step. The design of RTE must here negotiate an array of formidable technical problems ranging from estimating the reliability of teacher behaviors to selecting the correct statistic to cope with gain scores (BERLINER, 1976; KENNEDY/BUSH, 1976). In the end, however, the basic concept of RTE is uninfluenced by these scientific gymnastics.

Let us examine a simple illustration. When lecturing or giving instructions, should the teacher pause periodically to ask for questions and then answer them before proceeding? This is a bit of real teacher behavior which may be repeated thousands of

times in the course of an academic year. At least one recent study indicates that this behavior is significantly and negatively related to reading achievement in the lower grades. Pausing to solicit and answer questions is ineffective and persistently associated with poor student learning. Effective teachers are much less likely to do it (COKER et al., 1976).

The impact of this small bit of teacher behavior on student learning surely would be small. If the finding is replicated, however, it would become one more consistent thread in the broad tapestry of our knowledge about pedagogy. Only by teasing out these small, individual threads will the larger design be made apparent.

To this point in time there have been about fifteen studies performed in the USA which employed RTE in its full form. All of them have involved direct observation of real teachers in field settings, the use of reliable measures for long-term learning outcomes and the acquisition of large samples of teachers so as to provide an appropriate basis for generalization. All have produced results that are both statistically significant and large in their absolute magnitude (MEDLEY, 1977).

Such research studies cost a great deal of money and nearly all have involved some governmental funding. All have extended over a substantial period of time, all have been technologically complex, and all have employed relatively large staffs of research experts.

RTE has very real limits. It is not magic. For example, RTE does not tell us how to train teachers to engage in effective behaviors. Further, most of the RTEs performed so far deal with lower grade levels and the basic tool subjects of mathematics and language skills. Very little is known about effective teaching in such areas as social studies or art and music. Finally, in the enthusiasm for new insights produced by RTE it is important to remember that this form of research does not explain why certain behaviors are associated (statistically correlated) with learning. Unless we understand how a teaching method works to influence learning it is easy to be misled by simple correlations.

To illustrate, return for a moment to the earlier note about a negative association between the "pause for questions" strategy and reading achievement. This might indicate a causal relationship mediated by the active practice time lost in answering student questions. It might be, however, that this teacher behavior is not causal at all, but appears to be related to learning only because it is correlated with a third factor which truly is causal--perhaps teacher clarity. Teachers who are unclear may find it necessary to pause for questions. The poor results they produce may not arise from the act of pausing, but from the conditon of being unclear. If this is true, getting ineffective teachers to abandon their habit of pausing to ask and answer student questions might have no influence, or even a negative influence on student learning.

Clearly, description of associations is only a first step. RTE must be supplemented by various kinds of explanatory studies such as experiments or observation studies designed to test theoretical models (BROPHY, 1979).

RTE is a powerful tool. It becomes more powerful as the studies accumulate and we begin to provide replication for preliminary findings. The appearance of generic behaviors which seem to apply at several age levels, in different subject areas and with different kinds of students, is a particularly significant finding. Likewise, the discovery that many teacher behaviors seem to be situation specific is in itself an important discovery. Some strategies that work well in a school located in a low socio-economic, urban environment do not work well at all in an upper-class suburban school.

Perhaps the most reassuring conclusion is that given sufficient resources it is possible to discover reliable and apparently useful things about teaching (BROPHY, in press). Reading reports and reviews is a fascinating experience for any teacher. It is impossible to review here all of the RTE findings. In consequence I have selected just a few of the most interesting with which to illustrate the range and power of this new research strategy. First, there is unambiguous and impressive evidence that teachers do make a difference. Community environment, home environment and basic ability together account for the lion's share of student achievement. That certainly will be as true in the gymnasium as it is in the classroom. There is, however, a small and consistent part of learning that is attributable to teaching, and more specifically to the particular kind of teaching the student receives (GOOD, et al., 1975).

The fact that students with poor aptitude do not learn as well as students with high aptitude remains unchanged by any kind of teaching be it good or bad. That is an implacable fact of life. It also is a fact, however, that effective teachers consistently produce much greater learning gains in low ability students than do ineffective teachers.

Teaching makes only the difference it can make; it is not magic. Teaching is vital because it is the only factor we really can do much about in the short run. It is impossible to change a student's heredity, and socio-economic conditions change only slowly over generations. The quality of teaching, on the other hand, can make an immediate difference.

Second, it now is clear that no single teaching skill accounts for very much learning by itself. It is combinations of skills rather than single performances that constitute effective teaching. It is the right thing done at the right time for the right student, which produces effectiveness in the classroom or gymnasium. This fact writes "finish" to the half century search for the holy grail of the single "right" teaching method. It never existed (BROPHY/EVERTSON, 1976).

Teaching is the orchestration of a large number of limited principles that are situation specific. Most of the skills discovered through RTE appear to be fairly easy

to master. Learning when and how to use those skills may prove to be the more difficult task for a novice teacher.

Third, it now appears that the strongest generic element which cuts across situational variables is not a skill at all, but rather a teacher attitude. This attitude is best expressed in the way the teacher defines the role. Effective teachers persistently define teaching as a business in which they are personally responsible for whether the student learns or does not learn. They appear to believe that producing learning is their job. Situational factors seem not to alter that fundamental conviction.

This is not to say that effective teachers do not confront problems, or are foolish enough not to perceive them. Effective teachers are found in all kinds of problematic environments. The salient difference which marks them as exceptional is their attitude toward the problems.

Belief in personal accountability for the production of learning shapes teacher response to problems. For effective teachers, problems are things to be attacked because that is their definition of the job. If the student has low aptitude then it follows that more teacher attention, reteaching of crucial skills and larger doses of drill will be required. Effective teachers seem to assume that every student will learn what he or she should learn (BROPHY/EVERTSON), 1976).

Some years ago a researcher in the USA asked several hundred physical education teachers what they thought controlled how much students learned in their classes (MOORE, 1964). The teachers listed the factors of (1) availablity of equipment, (2) amount of time available, (3) student attitude toward physical education, (4) administrative support for such things as uniforms and discipline, and (5) home support from parents. How they taught as individual teachers simply was never mentioned. Personal responsibility for learning was not a fundamental premise of the teachers in that study. Student learning was seen mostly to be responsive to factors which were outside the control of the teacher. That is in sharp contrast to the basic attitude of effective teachers as revealed in RTE.

A fourth finding of interest is the fact that effective teachers tend to take charge of their classes and to retain that control. They condition student behavior rather than reacting to student behaviors. This requires a great deal more preplanning on the teacher's part, but it yields more time on learning tasks for the student. There appears to be no one particular method of organizing the class--it is organization itself which characterizes the effective teacher (MCDONALD, 1976).

Organizational strategies all seem to be concerned with a single factor--time. Time is regarded by effective teachers as something to be used--literally to be saved. Time is not seen as something just to be filled. Effective teachers organize so as to be in control of the use of time. For example, in the classes of effective and ineffective teachers, shot charts for junior high school math show significant

differences between the number of times students leave class to get drinks. More trips to the water fountain are consistently associated with less learning (ANDERSON, et al., 1978). It is obvious that this is not a causal assocation. It is unlikely that dehydration has much to do with the learning of sixth grade mathematics. It is more likely that organization itself is the active factor. Effective teachers tend to have a system for regulating such student beahviors. In consequence there are fewer interruptions which take students away from learning tasks.

The same phenomenon may be seen with regard to class discipline. Ineffective teachers spend about three times as much time on actions intended to suppress deviant behavior than do effective teachers. Surprisingly, both kinds of teachers use many of the same control techniques. The difference between teachers appears to be that effective teachers simply have fewer discipline problems. Effective teachers clearly do not have more compliant students. They are "problem preventers." By monitoring students carefully, by pre-planning to keep students busy, by smooth transitions between lesson segments, and by accurately targeting their responses when disruptions do occur, effective teachers sharply reduce the number of problem incidents and thus the time they spend on discipline problems (BROPHY/EVERTSON, 1976; KOUNIN, 1970).

A fifth finding of interest is the RTE result concerning student attitude. Here we are presented with a more complicated picture. Effective teachers produce learning, but how do the students feel about membership in such class units? Several studies have shown that in classrooms where teaching is effective, absence rates are much lower. Systems which tally smiling and laughing behaviors reveal higher rates in classes where absences are most infrequent (STALLINGS, 1976). Such findings provide an obvious and appealing answer to the question of student feeling about effective teaching. This does not, however, tell the entire story.

Whenever RTE employs measures of both academic achievement and student attitude, in about 70 percent of the cases achievement and attitude are both pushed in the same direction by their association with a given teacher behavior. For example, time spent on task is positively associated with both student learning and positive student attitudes. The teacher action of belittling students is negatively associated with both outcomes. At the junior high school level, teacher enthusiasm is positively associated with both factors (although this is not true at the elementary level). Abrupt transitions between class activities have a negative association with both achievement and attitude.

In the remaining 30 percent of the cases there is a differential impact by teaching behavior on the two student outcomes. These teacher behaviors may, for example, be positively associated with student learning but negatively associated with student attitude. What is gained in one direction is "traded off" for what is

lost in the other direction. In teaching as in other areas of life, it is not always possible to have one's cake and eat it too (EVERTSON, 1978).

A sixth finding of importance is the discovery that some relationships between behavior and learning are curvilinear. Too little of something is bad, and too much of it is equally bad. In such cases it is moderation that is associated with effective learning. It is not surprising, for example, that the level of difficulty inherent in teacher questions often follows this curvilinear path of influence on student learning (MEDLEY, 1977).

Seventh, the nature of punishment determines its influence upon learning. Mild and informational forms of punishment appear to be related to good learning at all grade levels. Strong punishment, and particularly corporal punishment, often shows negative relation to learning. Likewise, the use of subject matter as punishment is negatively related to learning (BROPHY/EVERTSON, 1976).

Those are some of the early findings produced by RTE. Although admittedly tentative, such results reflect significant forward strides in research methodology and data analysis. All of this is laudable, but existing RTE studies can tell us little about the teaching and learning of physical activity. To accomplish that end we must move from the classroom to the gymnasium.

An identifiable area of inquiry which might be called Sport Pedagogy now is slowly emerging in the USA. Three critical factors have cojoined to make this possible: 1) the development of tools for gathering data from the observation of physical activity instruction (CHEFFERS, 1977) and the concurrent emergence of a research tradition which demands the use of such tools (LOCKE, 1977; SHERMAN, 1978), 2) the appearance of a few studies authored by competent, senior professors thus marking an end to our total dependence on graduate student research as the source of new knowledge and, 3) a decline in the hitherto universal practice of "every man for himself" research and the development of a small number of programs in which researchers attack problems systematically and cumulatively, with replication and step-wise progression (SIEDENTOP, 1978).

This fledgling science already confronts a host of difficult choices. One of these is the act of self-definition. Shall we focus our energy and shape our style primarily to fit the demands of <u>understanding</u> how teaching works, or shall we concentrate on <u>improving</u> the work of teachers? The former choice would push us firmly toward generating a rich descriptive literature of life in the gymnasium. This would involve the tools of microethnology (BERLINER/TIKUNOFF, 1972; DOYLE, 1978; LOCKE, 1975; TEMPLIN, 1978) and descriptive analytic research employing multifaceted observation instruments (ANDERSON, 1974; ANDERSON/BARRETTE, 1978). These descriptive data would lead inevitably to explanatory models and theories of Sport Pedagogy.

The alternative choice of electing the role of "improver" rather than "understander" has great appeal in a society which has come to expect miracles from science. It is obvious that RTE provides information from which it should be possible to fashion advice for teachers. The difficulty here is obvious. Correlation studies do not indicate causality and in the absence of causal models, it is inevitable that we would urge some teacher behaviors which would prove useless or even disruptive.

Other choices are less fundamental, but no less perplexing. One decision faced by the researcher is whether to attempt RTE as a broad scale, field study technique, or to use a miniaturized research format which utilizes an experimental teaching unit (ETU). These are pre-packaged short curricula, ready for teacher use and complete with equipment, learning objectives and specimen test questions. ETUs employ novel and instrinsically interesting materials, and last for 2 to 5 weeks of daily class meetings. Teachers simply put the unit into the regular cycle of instruction in their own school. The investigator gathers the same information concerning teacher behaviors and student achievement as would be acquired in a full-scale RTE lasting a year or more.

ETUs offer great economy without trading off either content validity (the tests are designed for learning which the teacher really attempted to produce) or ecological validity (the teacher operates in his or her natural environment with a normal population of students). The ETU strategy also circumvents the problems presented by the great diversity of physical education curriculum content present even within a single school system in the USA. It is comparatively easy to find 100 third grade teachers of mathematics all teaching the same content at the same time. It is difficult if not impossible to find even 2 physical education teachers pursuing the same objectives, much less concurrently teaching the same content.

The limitations of the ETU strategy lie in the fact that it does not tap the effects which accrue from long-term association of teachers and students, that its novel subject matter produces an unknown degree of contamination in results, and that it produces no access to the vital factor of long-term consistency in teacher effectiveness.

A final example of the existing alternatives now open to the researcher in Sport Pedagogy is the mediating variable paradigm (DOYLE, 1977). Teaching does not cause learning directly. Teacher behaviors cause student behaviors and these are the proximate causes of learning. Such behaviors are considered "mediating" in that they come temporally between teacher actions and observed changes in student achievement. Instead of using student achievement as the dependent variable (as in the classic process/product paradigm), any one of several student learning behaviors can be selected which are known to have high correlation with student achievement. Attention to instruction (LOCKE/JENSEN, 1974; MCDONALD/ELIAS, 1976) and engagement in active performance of learning tasks (ROSENSHINE, 1976; SIEDENTOP, et al., 1978) are two student

behaviors which probably mediate between teaching and the learning of physical activities. The principal virtue of electing a mediating variable strategy is that it permits the researcher to avoid the difficulties of constructing a reliable learning measure in a complex sport or physical activity, and allows substitution of a simple measure such as student time expended on learning tasks.

To bring this paper to a close, I want to recount the story of a recent research project, a doctoral dissertation (YERG, 1977). This is the story of the first teacher effectiveness study in physical education. Of course it is a human story, involving a bright and ambitious young physical education teacher whose name is Beverly Yerg. She is teaching at Florida State University, but at the time all this happened she was a graduate student at the University of Pittsburgh.

Yerg didn't have forever to play at being a student. She soon had to get back to the real world of work and making a living. As a consequence, compromises were necessary in the name of practicality. She had to trade off some of the perfect study in order to get any study done at all.

The trick, of course, was to trade off things that didn't matter too much while keeping the essential elements of RTE intact. Instead of a full curriculum, her teachers taught only one skill--the cartwheel. Instead of working in schools, all of the teaching was done in the gymnasium at the University of Pittsburgh. Instead of using real teachers, undergraduate students preparing to be physical education instructors were used. Instead of using large classes, only three students were assigned to each teacher. Finally, instead of observing an entire year of teaching, Yerg's teachers were observed over only twenty minutes of instructional time.

It is easy to say that Yerg traded off far too much to permit any real approximation of RTE. Before you dismiss her work, however, I ask you to consider two things. First, this was an initial effort. There was no way to be sure exactly how best to apply RTE to physical activity. Second, she did have a valid learning task, live teachers and students, and a learning environment. They may not have been identical to the equivalent elements in the world of work, but they did represent each of the crucial components in RTE.

The investigator's first task was to develop a good measure of learning. The cartwheel test she devised involved taped body points, a standardized performance mat, high speed motion pictures, and an elaborate scoring system which proved itself capable of generating reliable achievement scores for each subject.

Next Yerg had to develop a good measure of teaching. She began with two teacher characteristics: knowledge about cartwheels (a twenty item objective test) and performance ability (the same cartwheel test which was applied to the students). Next she had to decide which teaching behaviors would be observed and recorded.

Which parts of your own teaching would you predict to be the main contributors to what children learn in your classes? Would it be your clear demonstrations? Your personal warmth and ability to encourage students? Your organization of lessons and sequencing of tasks? Your ability to simplify complex tasks with lucid explanations? Your correction of errors and prescription of correct performance? Your sensitivity to the need to individualize instruction? What would you select?

One thing is certain. You would be painstakingly careful. Time runs out rapidly, and everything must go on one roll of the dice. Few doctoral candidates can afford second tries.

For her shot chart of teacher behavior Yerg picked three broad territories of teacher action. First, she decided to record behaviors associated with presenting the task. This included explaining, demonstrating and stresssing key points. Second, she selected behaviors associated with the provision of practice trials. This included giving opportunity to practice, encouragement to take practice trials, and other supportive activities. Third, she selected the provision of feedback. This included giving information about performance and the associated feedback qualities of specificity and promptness.

For each of the three categories of teacher action, Yerg built a system to record all relevant behaviors, counting them up on the shot chart. Then she devised a system to add up the recorded tallies so as to produce a single score for each teacher in each area.

All the elements then were in place. There were five scores for each teacher derived from five reliable measures. These included two tests of teacher characteristics (knowledge and performance ability) and three measures of teaching behavior (task introduction, practice and feedback). With these scores in one hand, and in the other hand a reliable measure of student learning, Yerg was ready to do what had never been done with a physical activity before; to measure teacher effectiveness by RTE. She was ready to ask "what things do physical education teachers do to produce learning?"

At the end she had a small mountain of information. She punched it onto cards, fed it into the computer and held her breath. You may not think that research has its moments of high drama, but think again. It is not all dust and figures, theories and big words. It also is passion and people's dreams.

The first concern was whether the students learned anything at all. If they didn't show improvement, all would be lost. Fortunately, after twenty minutes of teaching and practice, their average score on a 100 point scale changed from 44 to 55. That was a learning gain--a significant gain. It did not seem like very much (only 11 percent) but it was there, and Yerg could relax.

The first odd note was struck when she observed that the teachers' scores on the cartwheel performance test averaged 47. That was somewhat higher than the average

student's pre-test score, but distinctly lower than the students' post-test average. She wondered about that.

The next worry was the teachers. If all of them were doing essentially the same thing, that too would destroy the investigation. There was no problem, however, for the shot charts showed the forty teachers striking out with a wide variety of instructional strategies.

Some sense of the teachers' general behavior may help you to follow the story. Teachers spent one-fifth of their time on the task of presenting the cartwheel. Two-fifths of their time was devoted to provision of practice. Of the remaining time, one-fifth was spent on feedback and one-fifth on the ubiquitous category of "other." This latter consisted mostly of management tasks such as telling students where to go and getting them into lines. With only three students, one fifth of the time was a surprisingly large portion to devote to class management.

The first result of the multiple regression analysis was entirely expected. Most of achievement test performance after any period of instruction is determined by student ability and prior achievement. In this case, pre-test scores of student cartwheels predicted 75 percent of the post-test scores. That one source, level of achievement before instruction, accounted for three-quarters of all the cartwheel skill observed after instruction. It is important to remember, however, that the effects of all previous teaching are imbedded in any pre-test achievement score.

Seventy-five percent may sound like a great deal, but comparatively speaking it is not. In classroom subjects the portion of achievement accounted for by initial student ability runs much higher, sometimes to 85 or 90 percent in language skills and mathematics. In such areas only 10 percent of student learning may be left within which the work of the teacher can have its influence. It may be that in motor skills there is a wider window to admit the impact of pedagogy.

It was a quite different matter that interested Yerg. How much of that 25 percent not accounted for by pre-test performance could be predicted by her 5 factors. The computer spewed forth paper and Yerg read the answer. It was "none"! Differences in teacher characteristics and teaching behaviors didn't seem to make any difference in learning at all. She checked all her figures, selected a new computer program and tried again. This time, the computer allowed 2 percent of the residual learning to factors associated with teaching. The remaining 23 percent was not accounted for by any of the teacher scores Yerg had entered into the equation. The variance in learning came from "an unknown source." Thus it was that the curtain came down on our first teacher effectiveness study in the gymnasium.

Bravely, Yerg wrote it all up, submitted her dissertation, received her degree and went back to teaching. Of course she asked "why?" Why didn't her selected teacher behaviors account for learning? What factors did account for the 23 percent not predicted

by initial student achievement? She certainly did not believe that teachers don't make any difference. I don't believe it and very probably you don't believe it either.

Why did our first RTE study come out that way? No one knows for sure, but there are some distinct possibilities. First, it may be that twenty minutes of teaching really does not make a difference with students who begin at a relatively low skill level and attempt to master a complex skill. Under those conditions it may be that other contextual factors (such as the autotutorial nature of many skills) are more powerful in determining learning. A second possibility is that teaching does make a difference under those conditions, but the investigator's shot charts were gathering data on the wrong behaviors. In other words, under those conditions the behaviors of introducing, practicing and providing feedback may be unimportant when compared with such factors as teacher warmth and enthusiasm. Third, the teachers themselves presented some problems. Clearly they were not experts either in performance (few of them could do a cartwheel as well as their students) or in pedagogy (they made rather inefficient use of the time available). Finally, it may be that the scoring of the behavior variables was at fault. For example, the absolute number of actual practice trials for each student never was calculated and entered directly as a prediction factor.

Further analysis of data from the YERG (1977) study (SHERMAN/YERG, in press) indicates both that the number of practice trials had a significant correlation with learning, and that teacher behaviors serving to reduce the number of trials had a negative influence. All forms of teacher talk had this negative effect, not excluding verbal feedback concerning performance. One hypothesis to account for this is that the children used as subjects lacked an adequate movement background and were not developmentally ready to utilize information about performance. What they needed at that point was simply to grasp the fundamental structure of the activity. Specific feedback not only was wasted, but actually was detrimental by preventing the exploratory practice trials which the subjects required.

I have my suspicion, Yerg has hers, and probably you have yours. That's how it goes in the real world of research. It is not all white coats and giving speeches. It includes disappointments, doing things wrong, and Mr. Murphy's famous law.

Was it worth it? Certainly the study did not demonstrate anything we didn't already know or suspect. Yet I think the Yerg dissertation has provided an invaluable service. It raised a question which is absolutely central in Sport Pedogogy, "what do effective teachers really do?" It employed a methodology which potentially can offer insights never before available. What is true of cartwheels also is true of research studies. First attempts tend to be imperfect.

A small but important portion of what any student achieves in the gymnasium is a consequence of what we do as teachers. It now is possible to find out which behaviors are effective and how they work. It is possible to learn from teaching.

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